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Nishikawa et al.

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(54) **SWITCH AND SWITCH DEVICE USING SAME**

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(51) **Int. Cl.**
H01H 9/00 (2006.01)

(52) **U.S. Cl.** **335/206**; 335/215

(58) **Field of Classification Search** 335/205–207, 335/215; 340/547; 324/207.21
See application file for complete search history.

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(57) **ABSTRACT**

Regarding a switch used for various controls of a motor vehicle in particular and a switch device using the switch, it becomes possible to simplify the configuration and to perform reliable detection of trouble. A first detector is disposed on a surface opposing to a magnet fitted to an actuator, and a second detector is disposed thereunder. A controller detects magnetism of the magnet by using the first detector and the second detector. In case one of the detectors is out of order, it can also be detected from ON/OFF signal from the first detector and the second detector.

5 Claims, 8 Drawing Sheets

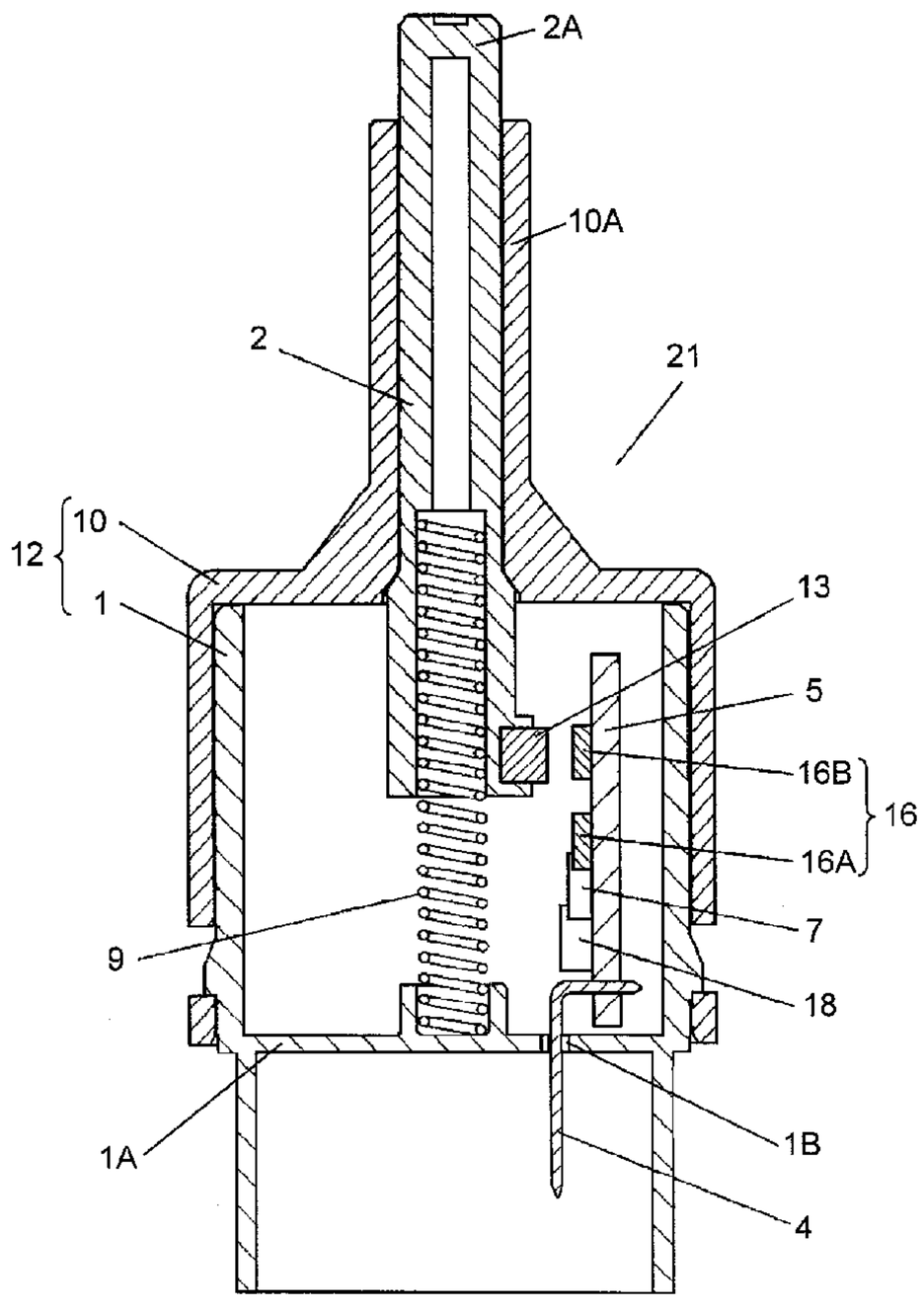


FIG. 1

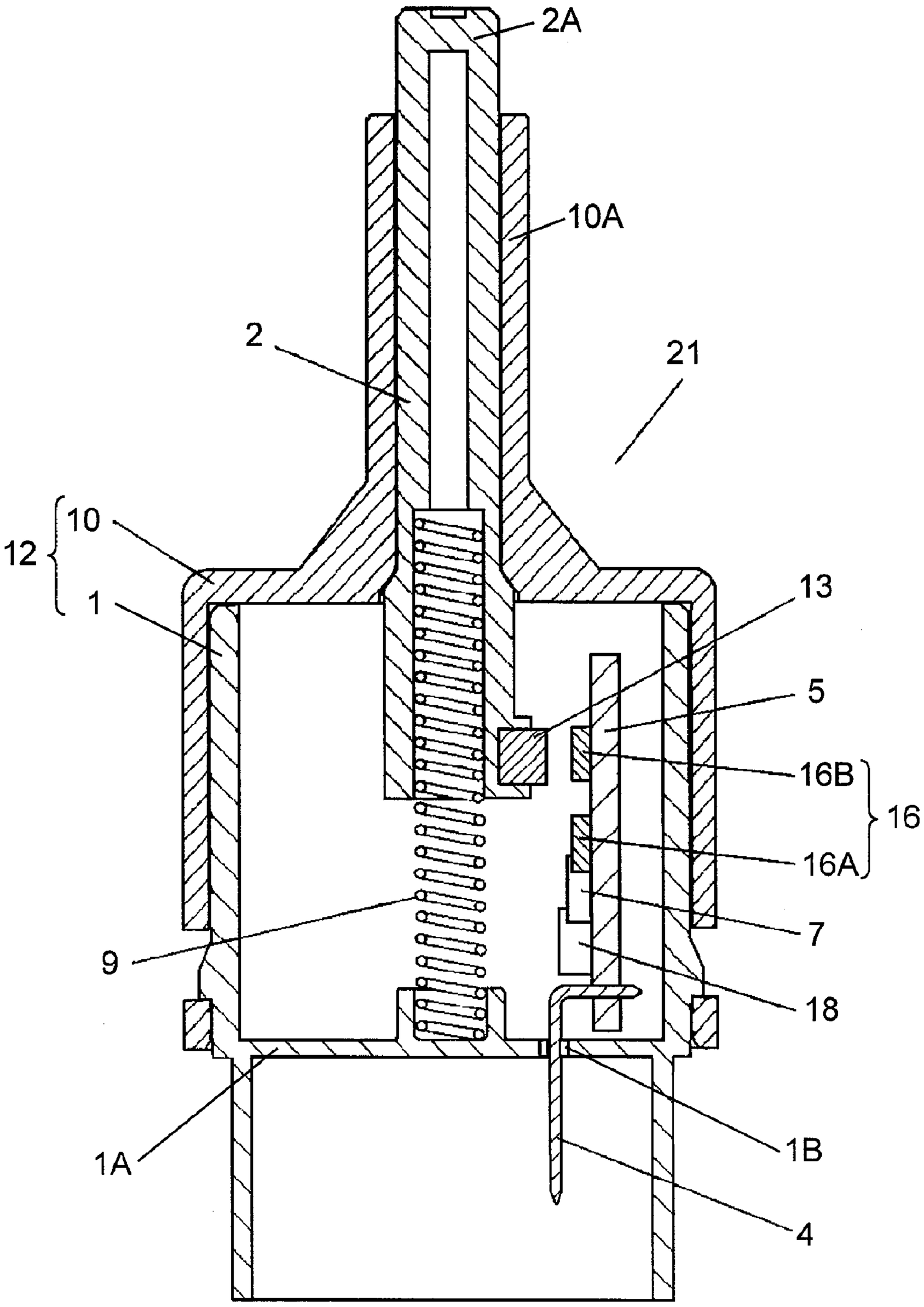


FIG. 2

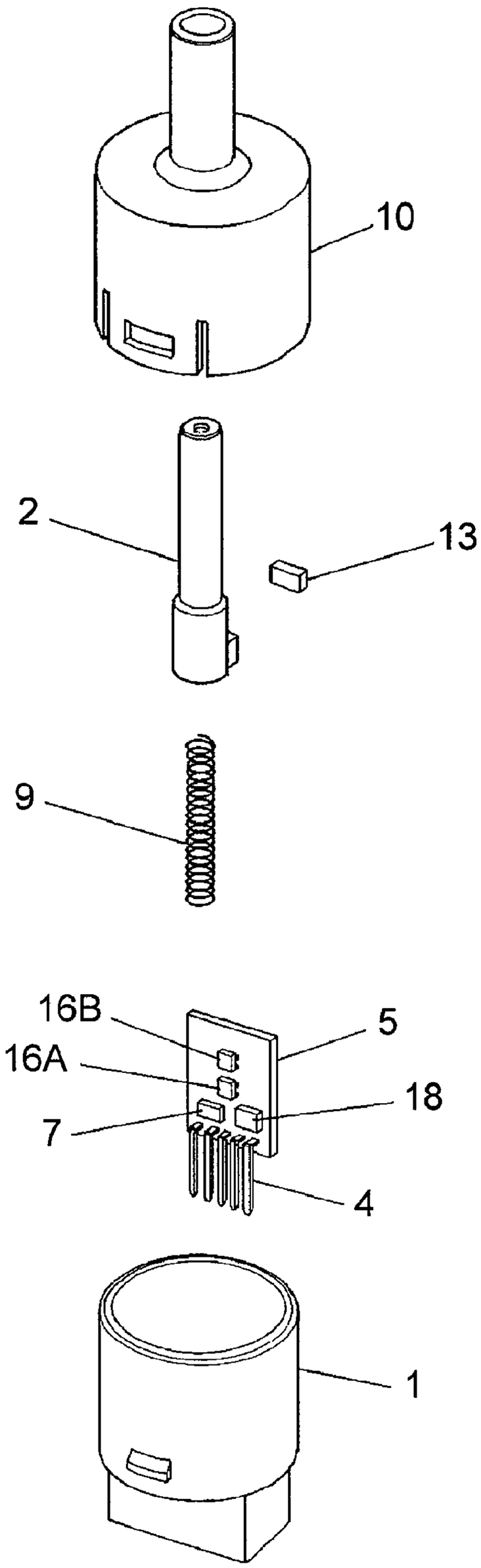


FIG. 3A

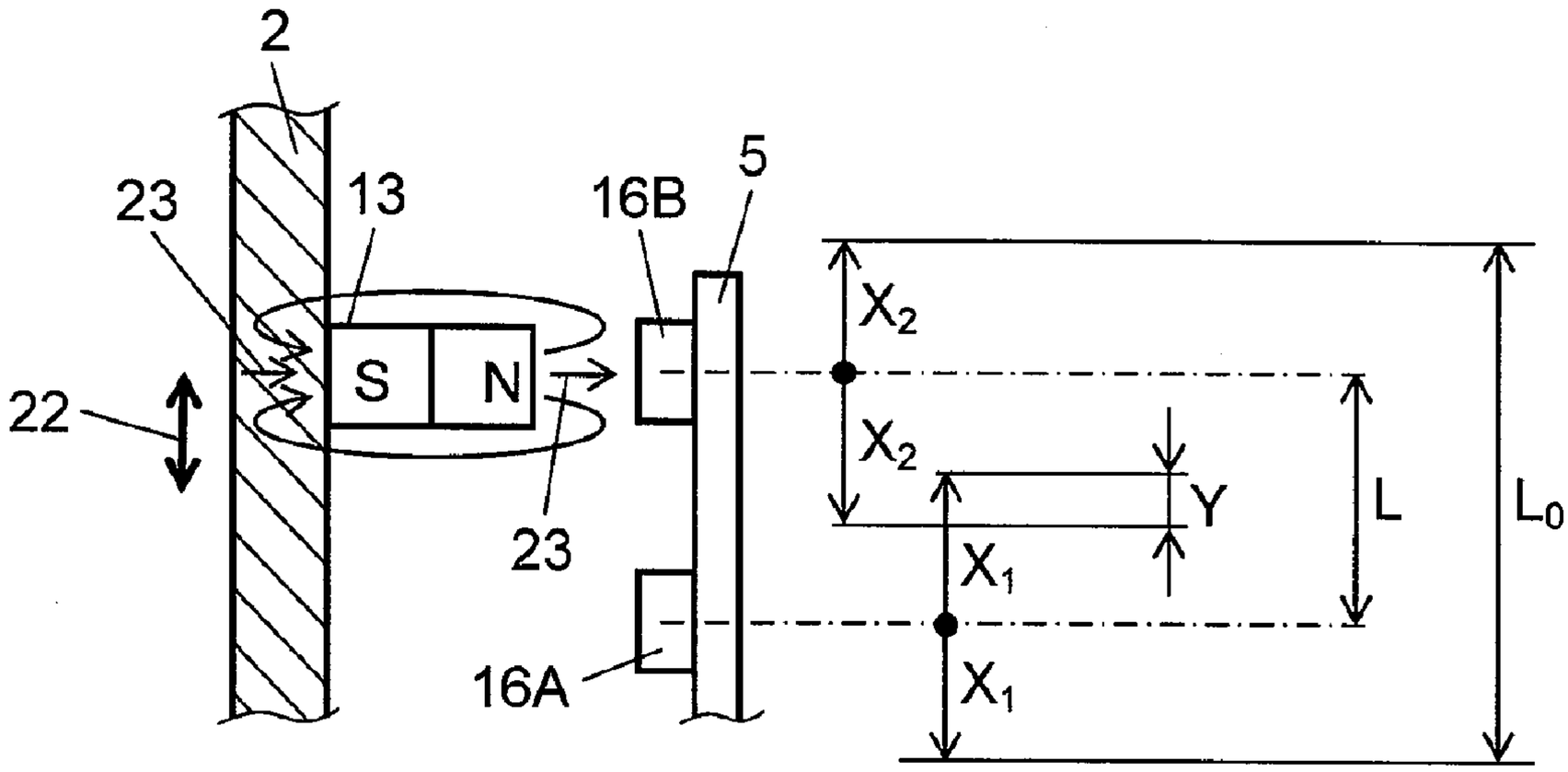


FIG. 3B

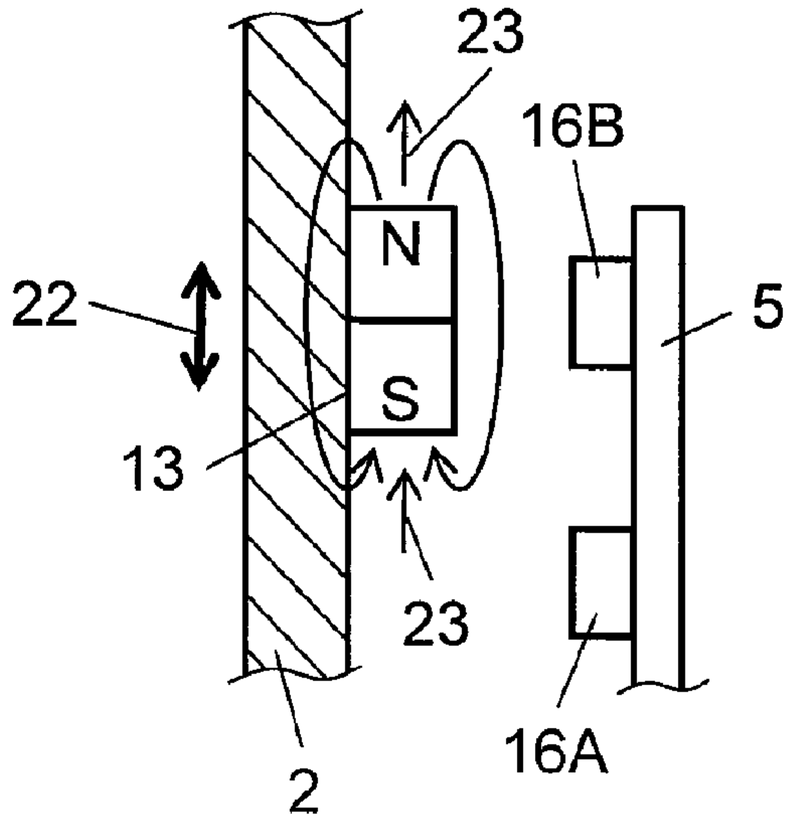


FIG. 4

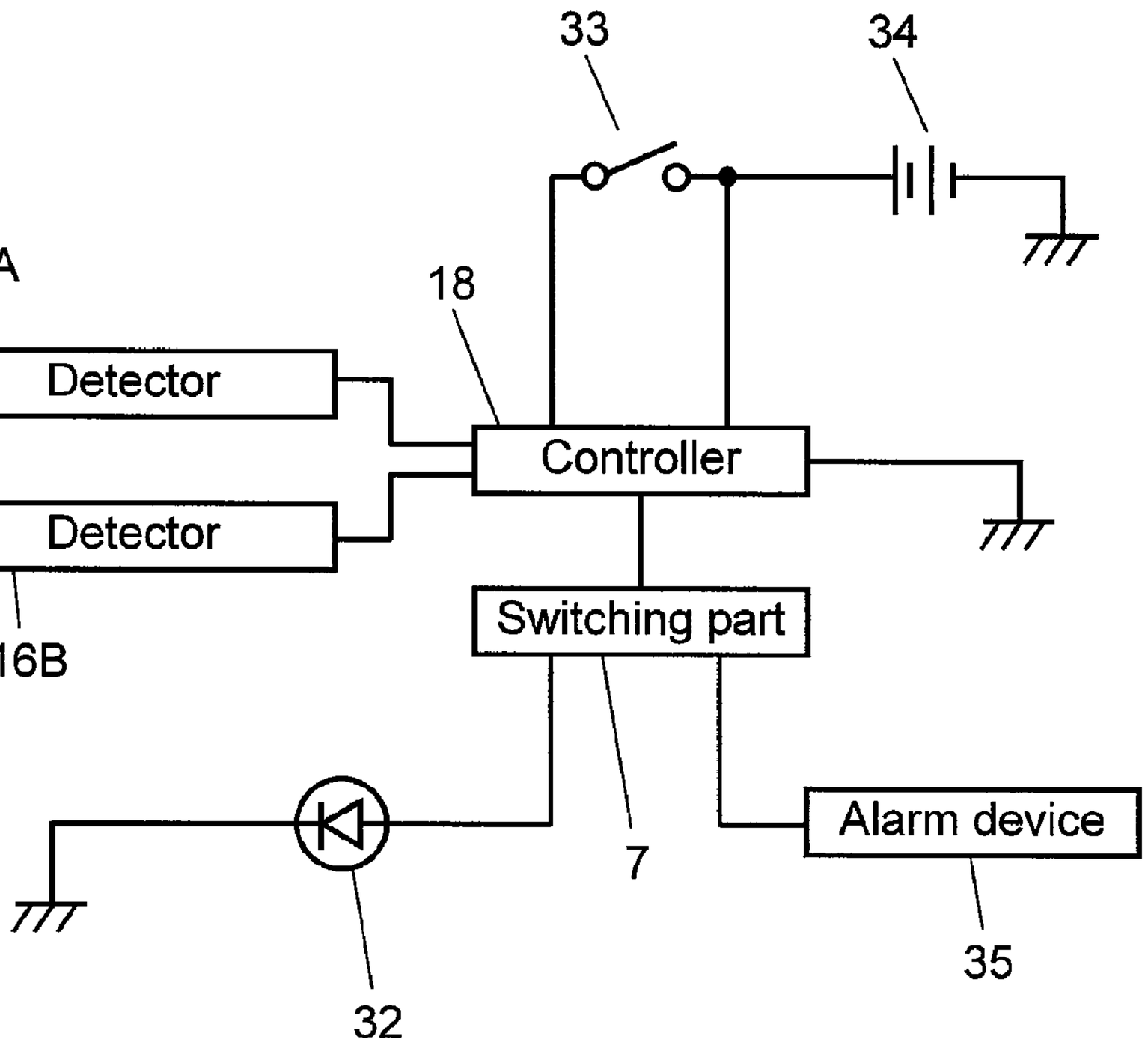

33
34
16A
18
Detector
Controller
Detector
Switching part
16B
7
Alarm device
35
32

FIG. 5

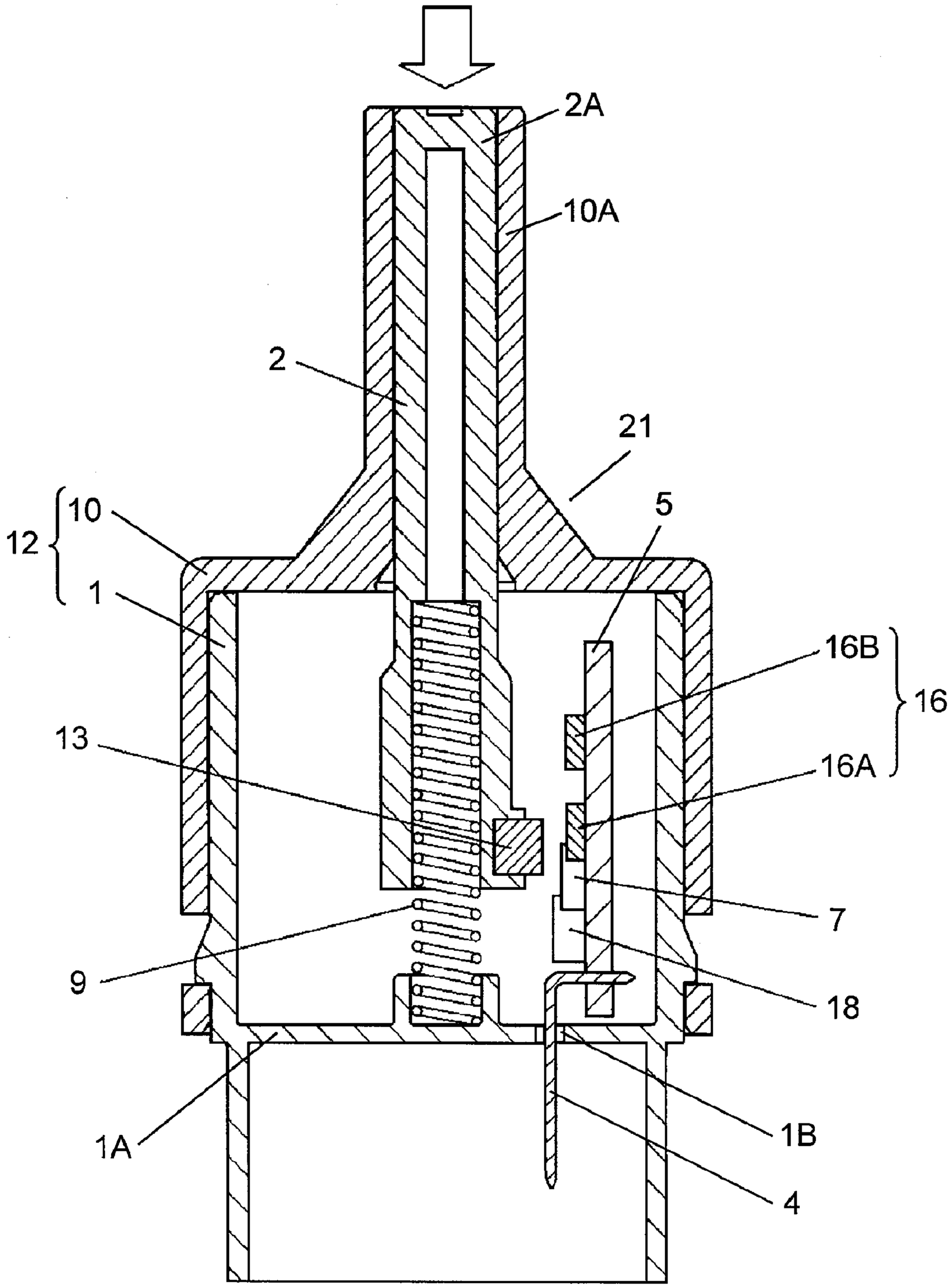


FIG. 6A

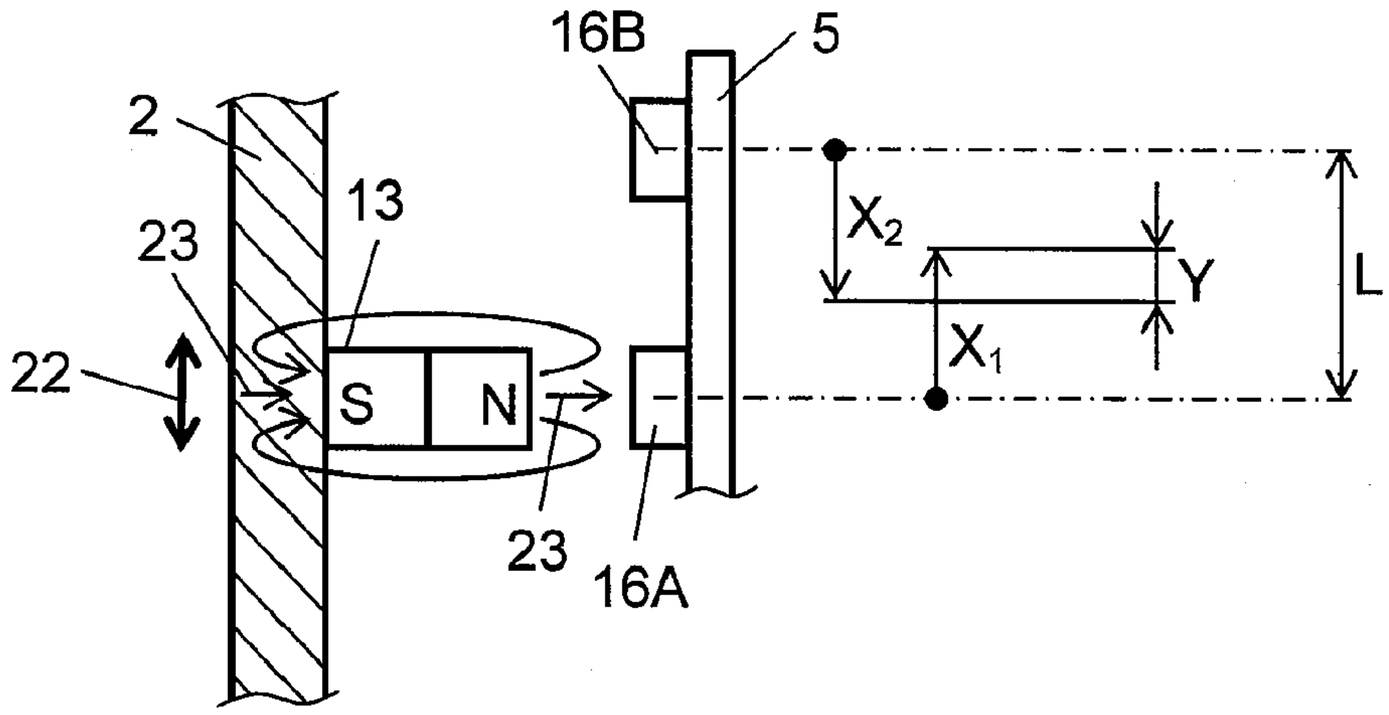


FIG. 6B

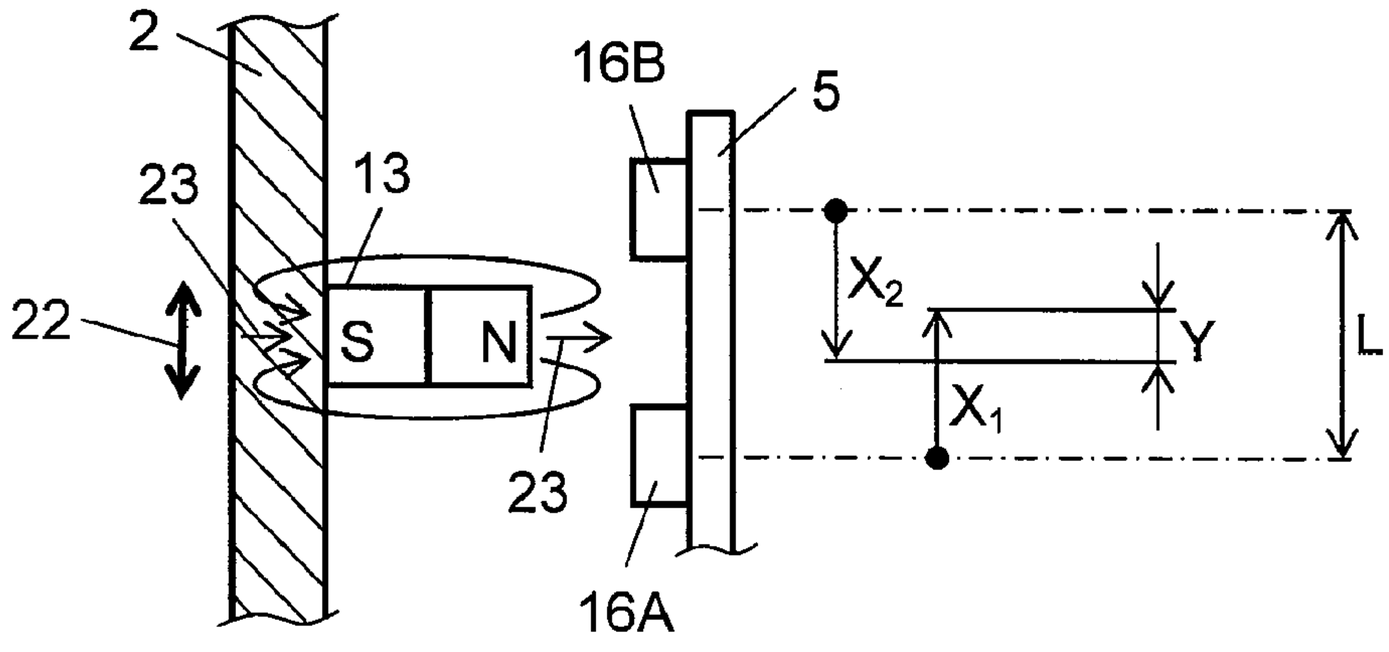


FIG. 6C

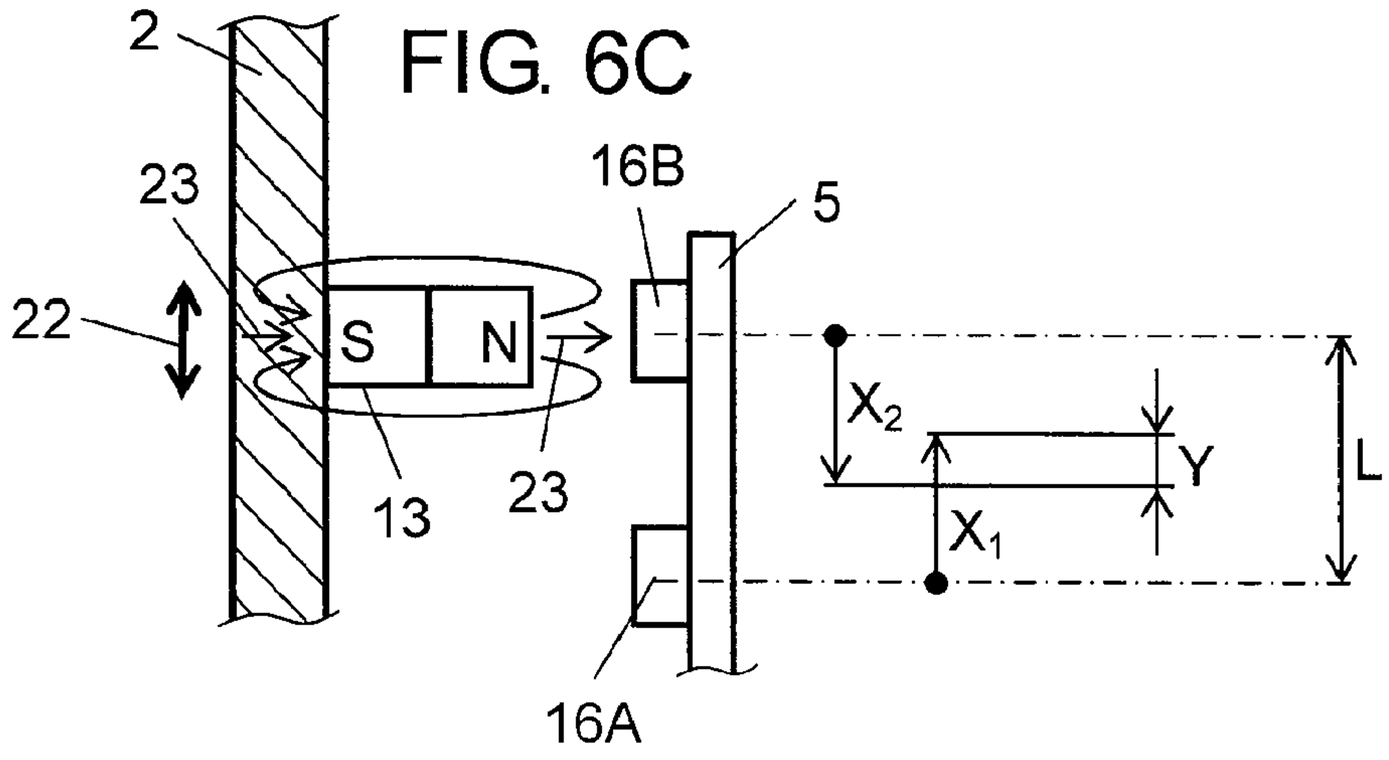


FIG. 7

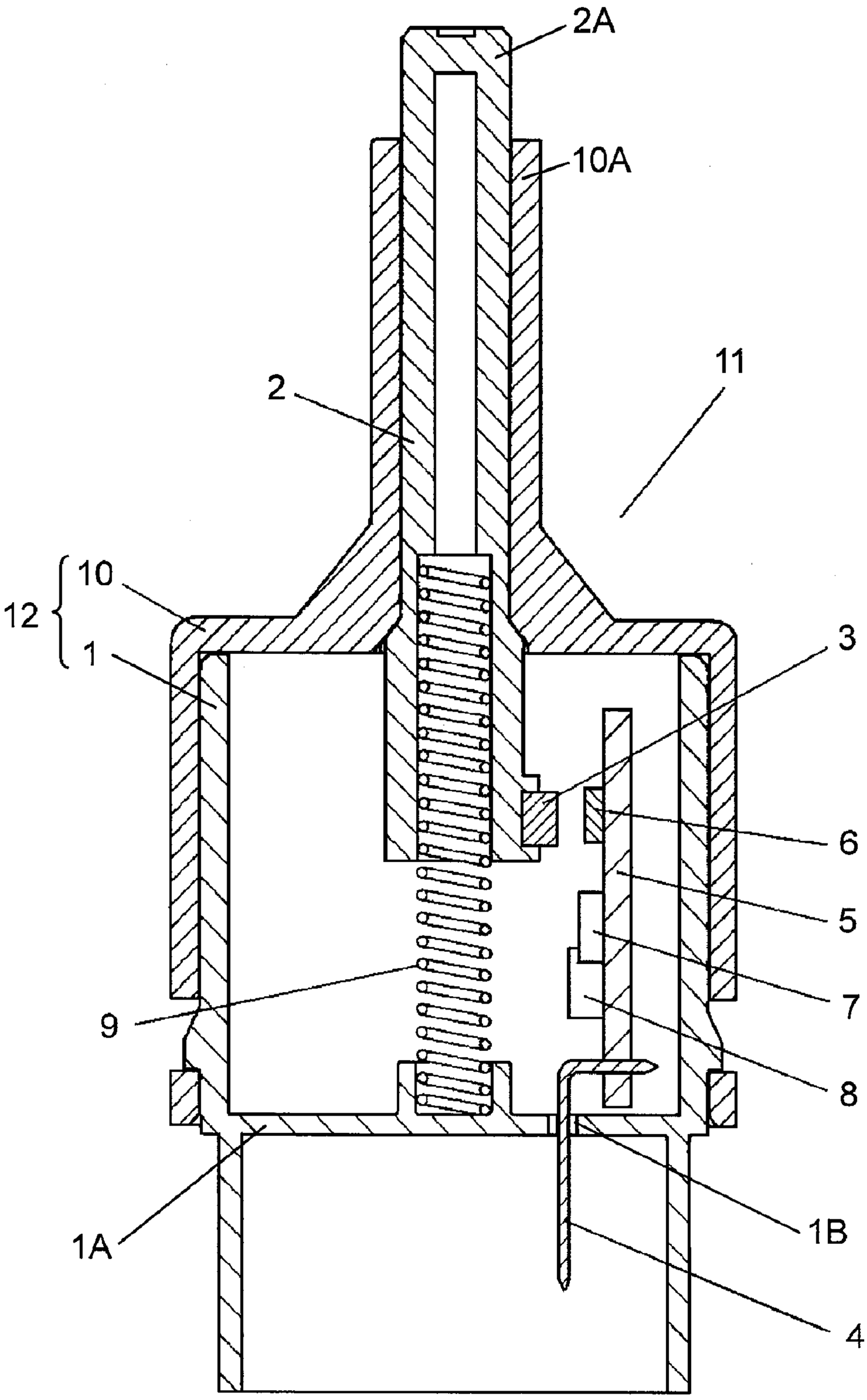
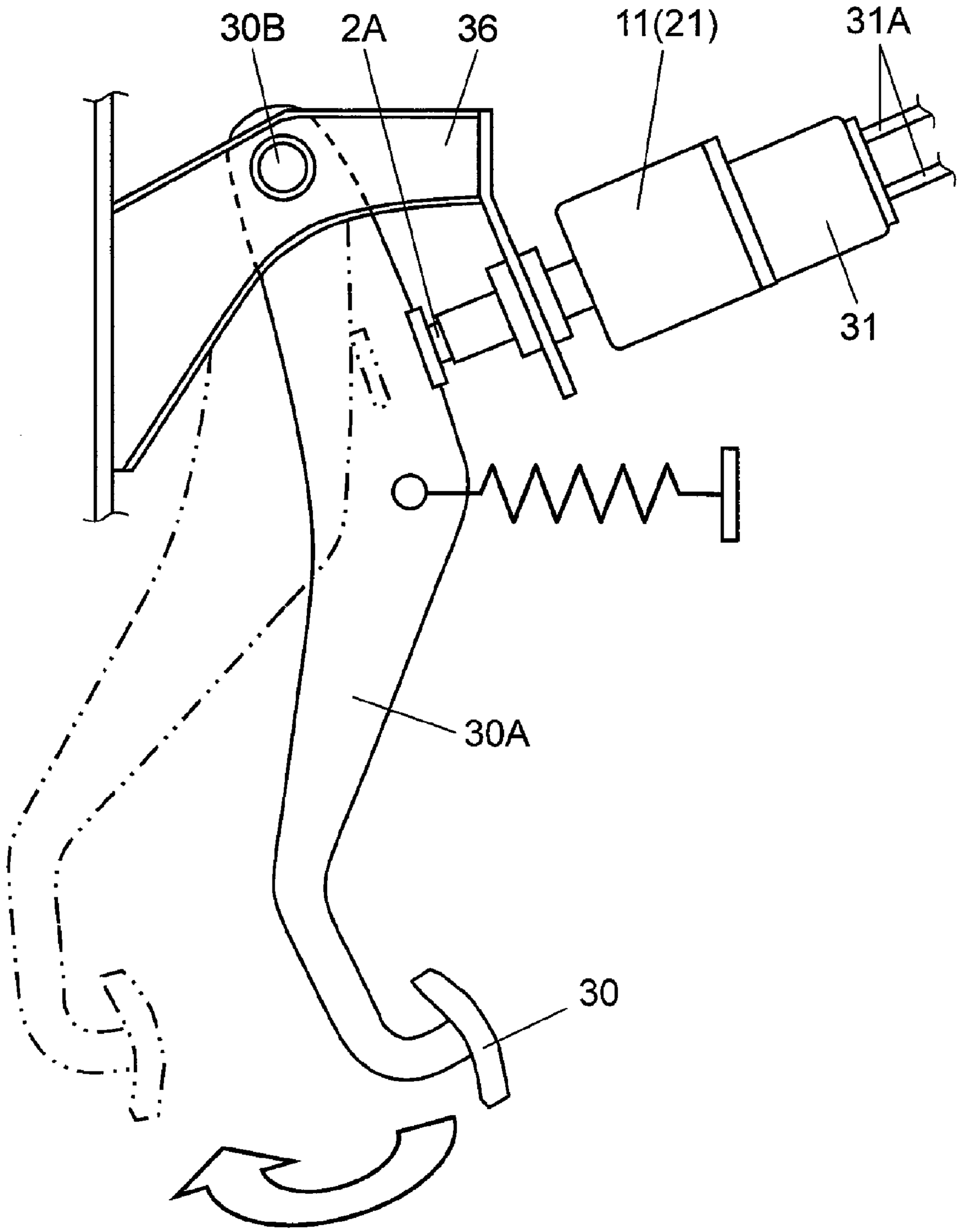


FIG. 8



SWITCH AND SWITCH DEVICE USING SAME

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a switch used for turning a stop lamp on/off for example when a brake pedal of a motor vehicle is operated in particular, and a switch device using the switch.

2. Background Art

Recently, a pressure type switch is used as a switch for transmitting the operation of a brake pedal to a controller. When the operation of the brake pedal depressed is transmitted, the controller serves to turn on a stop lamp. With the brake pedal released, the controller serves to turn off the stop lamp.

Such a conventional switch is described with reference to FIG. **7** and FIG. **8**. FIG. **7** is a sectional view of conventional switch **11**. In the figure, casing **12** includes case **1** and cover **10**. Case **1** is made of insulating resin and opens upward in the figure. Cover **10** is made of insulating resin and disposed so as to cover the opening of case **1**. Cylinder **10**A is disposed at the upper part of cover **10**. Actuator **2** and spring **9** are disposed in casing **12**. Actuator **2** is installed in such manner as to be vertically movable in cylinder **1**A. In the figure, coil spring **9** is disposed between a hollow portion of actuator **2** and bottom **1**A of case **1**. Due to restoring force of resilient spring **9**, actuator **2** is pressed against cover **10**. End **2**A of actuator **2** is protruded upward from cylinder **10**A.

Casing **12** is internally provided with magnet **3** and detector **6** in such manner as to be opposed to each other. Magnet **3** is disposed on the lower side surface of actuator **2**. Detector **6** is formed of Hall Element and the like and disposed on wiring board **5**. On wiring board **5** are disposed switching part **7** such as transistor or the like, and controller **8** formed of FET and a plurality of fixed resistors, etc. As to a plurality of terminals **4** made of conductive metal, one end thereof is connected to wiring board **5**, and the other end is protruded outside the casing **12** from hole **1**B of bottom **1**A. Wiring patterns are provided on the right and left surfaces of wiring board **5**. Terminal **4**, detector **6**, switching part **7**, and controller **8** are electrically connected via the wiring patterns. These electronic parts are electrically connected by using solder or the like.

FIG. **8** shows a state of above-mentioned switch **11** mounted in a motor vehicle. Switch **11** and arm **30**A are fitted to holding member **36**. Arm **30**A and holding member **36** are connected to each other on fulcrum **30**B of arm **30**A. Brake pedal **30** is attached to the tip of arm **30**A. Arm **30**A and switch **11** are in contact with each other via the end **2**A of actuator **2**. Connector **31** is connected to switch **11**. Terminal **4** shown in FIG. **7** connects to a stop lamp and ignition switch of the motor vehicle, battery, electronic circuits of the motor vehicle, etc. via lead wires **31**A of connector **31**.

In FIG. **8**, the state of arm **30**A and brake pedal **30** shown by solid line indicates a state obtained when brake pedal **30** is not depressed. The state of arm **30**A and brake pedal **30** shown by broken line indicates a state obtained when brake pedal **30** is depressed.

In this case, switch **11** shown in FIG. **7** changes as described in the following when brake pedal **30** is depressed. When brake pedal **30** is not depressed, the pressing force is applied downward in FIG. **7** to the end **2**A of actuator **2**. In other words, actuator **2** is in a state of being pressed downward. Magnet **3** disposed on the side surface of actuator **2** moves downward along with actuator **2**. When brake pedal **30** is pressed, magnet **3** confronted detector **6**, and when brake pedal **30** is not depressed, magnet **3** is positioned far away from detector **6**. Consequently, the magnetism of magnet **3** detected by detector **6** becomes very weak.

Controller **8** operates as follows in accordance with the intensity of magnetism detected by detector **6**.

When the magnetism detected exceeds the specified value, controller **8** detects that switch **11** is ON. As a result, controller **8** sets switching part **7** to ON and turns on the stop lamp. When the magnetism detected is less than the specified value, controller **8** detects that switch **11** is OFF. As a result, controller **8** sets the switching part **7** to OFF and turns off the stop lamp.

As described above, with actuator **2** depressed downward, the magnetism detected by detector **6** is very weak, that is, the magnetism is less than the specified value. Accordingly, controller **8** detects that switch **11** is OFF, then it sets the switching part **7** to OFF and turns off the stop lamp.

When brake pedal **30** is depressed, the inside of switch **11** shown in FIG. **7** becomes as described in the following. When brake pedal **30** is depressed, arm **30**A moves apart from the end **2**A of actuator **2**. As a result, the pressing force applied to actuator **2** by means of arm **30**A is released, and then, due to the restoring force of resilient spring **9**, actuator **2** is moved upward. The condition is shown in FIG. **7**. At the time, magnet **3** disposed on the side surface of actuator **2** moves upward along with actuator **2**. As a result, magnet **3** and detector **6** become opposed to each other, intensifying the magnetism of magnet **3** detected by detector **6**. In other words, the magnetism detected by detector **6** becomes higher than the specified value, and controller **8** detects that switch **11** is ON. And controller **8** sets switching part **7** to ON and turns on the stop lamp.

That is, conventional switch **11** operates as follows. Actuator **2** vertically moves in cylinder **10**A in accordance with the operation of brake pedal **30**. Magnet **3** disposed on the side surface of actuator **2** moves along with actuator **2**. The magnetism detected by detector **6** varies in accordance with the movement of magnet **3**. When the magnetism detected by detector **6** is higher than the specified value, controller **8** detects that switch **11** is ON. When the magnetism detected by detector **6** is less than the specified value, controller **8** detects that switch **11** is OFF. In accordance with the detection result of controller **8**, controller **8** sets the switching part **7** to ON/OFF, and turns on/off the stop lamp.

As prior art, for example, Unexamined Japanese Patent Publication No. 2006-92777 is known.

Incidentally, in case of trouble with detector **6**, the value transmitted from detector **6** to controller **8** becomes constant. Consequently, even when actuator **2** moves upward or downward, only a signal showing that switch **11** is OFF is transmitted from detector **6** to controller **8**. That is, in the case of conventional switch **11**, actuator **2** is pressed, and therefore, it is unable to detect whether OF is detected by detector **6** or OFF is detected because of trouble with detector **6**.

SUMMARY OF THE INVENTION

The switch comprises a casing, an actuator which is movable in a predetermined direction with respect to the casing, a magnet fixed to the actuator, a first detector which is fixed in the casing for detecting the magnetism generated from the magnet, and a second detector for detecting the magnetism, which is disposed in a position a specified distance apart along the predetermined direction from the first detector.

By using such a switch, it is possible to simplify the configuration and to detect troubles in the first detector and the second detector with great accuracy.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a sectional view of a switch in the first embodiment of the present invention.

FIG. **2** is an exploded perspective view of a switch in the first embodiment of the present invention.

FIG. **3**A is an explanatory diagram of an essential portion of a switch in the first embodiment of the present invention.

FIG. **3**B is an explanatory diagram of an essential portion of a switch in the first embodiment of the present invention.

FIG. **4** is a block circuit diagram of a switch device in the first embodiment of the present invention.

FIG. **5** is a sectional view of a switch in the first embodiment of the present invention.

FIG. **6**A is an explanatory diagram of an essential portion of a switch in the first embodiment of the present invention.

FIG. **6**B is an explanatory diagram of an essential portion of a switch in the first embodiment of the present invention.

FIG. **6**C is an explanatory diagram of an essential portion of a switch in the first embodiment of the present invention.

FIG. **7** is a sectional view of a conventional switch.

FIG. **8** is a side view of an essential portion of a conventional brake pedal.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The switch and switch device in the first embodiment of the present invention will be described in the following with reference to the drawings.

The same components as those described in the background art are given same reference numerals, the contents of which are incorporated herein.

First Embodiment

FIG. **1** is a sectional view of a switch according to a first embodiment of the present invention. FIG. **2** is an exploded perspective view according to the first embodiment of the present invention. In FIG. **1** and FIG. **2**, casing **12** is formed of case **1** and cover **10**. Case **1** is made of insulating resin and opens upward in the figure. Cover **10** is made of insulating resin and disposed so as to cover the opening of case **1**. As insulating resin, polybutylene terephthalate or ABS (Acrylonitrile Butadiene Styrene) or the like can be used. Cylinder **10**A is disposed at the upper part of cover **10**. Actuator **2** and coil-shaped spring **9** are disposed in casing **12**. Actuator **2** is cylindrical and made of insulating resin such as polybutylene terephthalate and ABS or the like. Actuator **2** is installed in such manner as to be vertically movable in cylinder **11**A so that can move in the predetermined direction with respect to casing **12**. A prescribed direction where actuator **2** moves with respect to casing **12** is called the predetermined direction. In the first embodiment of the present invention, actuator **2** moves the inside of cylinder **10**A in the vertical direction in FIG. **1**. That is, the vertical direction becomes the predetermined direction. The predetermined direction may satisfy the following conditions. Actuator **2** moves in a constant direction. It enters the state where detector **6** detects or not detect magnetism of magnet **3** according to the movement of actuator **2**.

In FIG. **1**, spring **9** is disposed between the hollow portion of actuator **2** and bottom **1**A of case **1**. Due to the restoring force of resilient spring **9**, actuator **2** is pressed against cover **10**. End **2**A of actuator **2** is protruded upward from cylinder

1A. Spring **9** is just required to have restoring force and therefore it is preferable to be any other spring or resilient member having restoring force

Casing **12** is internally provided with magnet **13** and detector **16** in such manner as to be opposed to each other. Detector **16** has detector **16**A as a first detector and detector **16**B as a second detector. Detector **16**A is in a position opposing to magnet **13** when brake pedal **30** is not depressed. Detector **16**B is in a position opposing to magnet **13** when bake pedal **30** is depressed. Magnet **13** is fixed to the surface of actuator **2**. In the first embodiment, magnet **13** is disposed on the lower side surface of actuator **2**. Detector **16**A and detector **16**B are formed of Hall Elements, SMR Elements (Semiconductor MagnetoResistive Elements) or the like, and disposed on wiring board **5**. Switching part **7** such as transistors or the like, and controller **18** formed of FET and a plurality of fixed resistors, etc, are disposed on wiring board **5**. As to a plurality of terminals **4** made of conductive metal such as copper alloy, one end thereof is connected to wiring board **5**, and the other end is protruded outside the casing **12** from hole **1**B of bottom **1**A. Wiring patterns are provided on the right and left surfaces of wiring board **5**. Terminal **4**, detector **16**A, detector **16**B, switching part **7**, and controller **18** are electrically connected via the wiring patterns. These electronic parts are electrically connected by using solder or the like.

Switch **21** having such a configuration will be described in detail with reference to FIG. **3**A and FIG. **3**B.

Actuator **2** moves along the predetermined direction **22** shown in FIG. **3**A. The relative positions between magnet **13** and detector **16**A change along predetermined direction **22**. Magnet **13** includes an S pole and an N pole in a direction intersecting the predetermined direction **22**. Since magnet **13** generates a flow of magnetism from the N pole to the S pole, as shown in FIG. **3**A, the N pole is preferable to be disposed at detector **16**A, detector **16**B.

Detector **16**A and detector **16**B are disposed along the same direction as predetermined direction **22**. Accordingly, the S pole and the N pole of magnet **13** are desirable to be arranged in a direction intersecting the predetermined direction **22**. In this way, when magnet **13** is positioned before detector **16**A and detector **16**B, the strongest flow of magnetism **23** formed by the S pole and the N pole of magnet **13** can be supplied to detector **16**A and detector **16**B. It is more preferable to make the arrangement so that the S pole and the N pole of magnet **13** are perpendicular to predetermined direction **22**.

FIG. **3**B shows an example of comparison with respect to the installing direction of magnet **13**.

In FIG. **3**B, magnet **13** is arranged so that the S pole and the N pole are in same direction as predetermined direction **22**. In this case, the strongest flow of magnetism **23** formed by the S pole and the N pole of magnet **13** is generated in same direction as predetermined direction **22**. As a result, in the arrangement shown in FIG. **3**B, the strongest flow of magnetism **23** formed by the S pole and the N pole of magnet **13** cannot be supplied to detector **16**A and detector **16**B.

As is obvious in the result of comparison described above, when the S pole and the N pole of magnet **13** are disposed in a direction perpendicular to predetermined direction **22** in the arrangement, the strongest flow of magnetism **23** formed by the S pole and the N pole of magnet **13** can be supplied to detector **16**A and detector **16**B. In other words, magnetism generated from magnet **13** can be efficiently transmitted to detector **16**A and detector **16**B. As a result, the accuracy of detecting the position of magnet **13** can be enhanced. Also, since the magnetism can be efficiently transmitted from mag-

net **13** to detector **16**A and detector **16**B, it enables the size reduction of magnet **13**, detector **16**A, and detector **16**B.

Next, as shown in FIG. **3**A, detector **16**A and detector **16**B are installed in positions where the following formulas are satisfied.

$$X1<L<X1+X2$$

$$X2<L<X1+X2$$

X**1** shows the maximum distance at which detector **16**A is able to detect magnetism. X**2** is the maximum distance at which detector **16**B is able to detect magnetism. L shows the distance between the centers of detector **16**A and detector **16**B. That is, distance L between centers is longer than maximum distances X**1**, X**2** at which detectors **16**A and **16**B respectively detect magnetism. And, it is shorter than the value satisfied by detector **16**A and detector **16**B with respect to the distance at which each of them is able to detect magnetism. Also, the detail will be described later, but there is provided section Y in which both of detectors **16**A and **16**B are able to detect magnetism.

In the above arrangement, either detector **16**A or detector **16**B is able to detect the magnetism generated from magnet **13** in movement range L**0** of magnet **13**.

In other words, monitoring the output of detector **16**A or detector **16**B, in case the detection of magnetism cannot be confirmed from any one of detector **16**A and detector **16**B simultaneously, it can be detected that at least one of detector **16**A and detector **16**B is in trouble.

That is, the configuration is very simple and it is possible to obtain switch **21** capable of detecting abnormality such that detector **16**A or detector **16**B is out of order.

Particularly, as shown in FIG. **3**A, there is provided section Y where both detectors **16**, detector **16**A and detector **16**B, are able to detect magnetism. Due to such section Y provided, the detection of trouble can be reliably performed in the entire region where magnetism generated from magnet **13** is detected by detector **16**A and detector **16**B.

Specifically, suppose that the maximum distance at which detector **16**A and detector **16**B are able to detect magnetism is X**1**, X**2**=2.6 mm. The central distance between detector **16**A and detector **16**B installed is L=4.2 mm. In this way, the movement of magnet **13** can be detected over the entire length L**0** =6.8 mm. Particularly, in the section where detector **16** for detecting the magnetism of magnet **13** is changed over from detector **16**A to detector **16**B, there is provided section Y where the magnetism is detected by both of detector **16**A and detector **16**B. In section Y, a sufficient distance is ensured including variation of characteristics of the elements configuring detector **16**A and detector **16**B. In such a configuration, the position of magnet **13** can be more reliably detected. With respect to the specific example described above, the inventor ensures section Y=1 mm.

Switch **21** showing the first embodiment of the present invention is installed in a motor vehicle.

For the description of such an installation, the above description of FIG. **8** is quoted. Also, the block circuit diagram of a switch device that can be configured by installing switch **21** in a motor vehicle is shown in FIG. **4**.

In FIG. **4**, when ignition switch **33** is set to ON, power is supplied from battery **34** to controller **18**. With power supplied, controller **18** checks detector **16**A and detector **16**B. Controller **18** turns ON and OFF the switching part **7** in accordance with the state of detection, and controls the operation of turning on/off stop lamp **32** formed of a lamp or light-emitting diode and the like. Also, when controller **18** detects abnormality, it turns on the switching part **7**, and for example, it gives an instruction to alarm device **35** formed of a warning lamp or buzzer and the like so that the person is informed of the abnormality.

By using FIG. **1**, FIG. **5** and FIG. **6**A to FIG. **6**C, the procedure for detecting the state of brake pedal **30** being pressed will be described.

FIG. **5** shows a state of brake pedal **30** not pressed. As against the specific example described above, it shows that actuator **2** is being pressed by 6 mm. In this case, actuator **2** is pressed downward by means of arm **30**A. As actuator **2** moves downward, magnet **13** disposed on the lower side surface of actuator **2** also moves downward. Then, the relationship between magnet **13**, detector **16**A and detector **16**B is as shown in FIG. **6**A.

FIG. **6**A shows the state of actuator **2** pressed. In this condition, magnet **13** fixed to actuator **2** is positioned at the starting point of the movement in predetermined direction **22**. As shown in FIG. **6**A, magnet **13** is positioned close to detector **16**A. In this case, detector **16**A detects high magnetism generated from magnet **13**. That is, since the magnetism detected by detector **16**A is higher than the specified value, ON signal is transmitted to controller **18**. On the other hand, detector **16**B is at a position farther than the maximum distant X**2** at which the magnetism of magnet **13** can be detected, and therefore, it is unable to detect the magnetism generated from magnet **13**. That is, since the magnetism detected by detector **16**B is lower than the specified value, OFF signal is transmitted to controller **18**. Controller **18** receives ON signal from detector **16**A and OFF signal from detector **16**B, and detects that brake pedal **30** is not depressed. And, controller **18** sets the switching part **7** to OFF and turns off the stop lamp **32**.

Next, when brake pedal **30** is depressed, the pressing force applied to actuator **2** is released. Consequently, switch **21** operates to change the position of actuator **2** from FIG. **5** to FIG. **1**. The relationship between magnet **13**, detector **16**A and detector **16**B changes from FIG. **6**A to FIG. **6**C via FIG. **6**B.

The state of FIG. **6**B is described in the following. FIG. **6**B shows a state that magnet **13** is passing the middle between detector **16**A and detector **16**B. When magnet **13** moves from the position of FIG. **6**A to the position of FIG. **6**B, the magnetism of magnet **13** that can be detected by detector **16**A becomes lowered. On the other hand, detector **16**B is unable to detect the magnetism of magnet **13** in the state of FIG. **6**A, but it becomes able to detect the magnetism of magnet **13** in the state of FIG. **6**B. In this case, both of detector **16**A and detector **16**B detect magnetism higher than the specified value. And, both of detector **16**A and detector **16**B transmit ON signal to controller **18**. As a result, controller **18** detects that brake pedal **30** is in a transient state. Controller **18** keeps the switching part **7** set at OFF and the stop lamp **32** turned off.

After that, as a result of depressing the brake pedal **30**, switch **21** is shifted to the state shown in FIG. **1** and FIG. **6**C.

In the process from FIG. **6**B to FIG. **6**C, as magnet **13** moves farther away from detector **16**A, the magnetism of magnet **13** detected by detector **16**A becomes lower. On the other hand, the magnetism of magnet **13** detected by detector **16**B becomes higher. And, when the magnetism detected by detector **16**A becomes lower than the specified value, detector **16**A transmits OFF signal to controller **18**. During the range from receiving the OFF signal from detector **16**A until reaching the state of FIG. **6**C, controller **18** detects that brake pedal **30** is in a state of being depressed. That is, receiving ON signal from detector **16**B and OFF signal from detector **16**A, controller **18** sets the switching part **7** to ON and turns on the stop lamp **32**. FIG. **6**C shows a state that actuator **2** is pressed

against cover **10**. This condition shows that magnet **13** fixed to actuator **2** is positioned at the end of movement in predetermined direction **22**.

In the first embodiment of the present invention described above, particularly in the section where the magnetism detecting element changes over from detector **16**A to detector **16**B, it is possible to obtain the following advantages by providing section Y where both detection regions overlap each other.

The trouble in detector **16**A and detector **16**B can be detected in the entire range where the position of magnet **13** is detected by detector **16**A and detector **16**B. When a trouble is generated in detector **16**A and detector **16**B, controller **18** detects that abnormality has been generated.

As described above, detector **16**A and detector **16**B, when magnet **13** comes close to them, transmits ON signal to controller **18** to inform it of the position of magnet **13**. Controller **18** detects ON/OFF signal from detector **16**A and detector **16**B, and thereby, it detects whether there exists pressing force against actuator **2**. Detecting whether there exists pressing force against actuator **2**, controller **18** determines the state of depression of brake pedal **30**.

As is obvious in the above description, when ignition switch **33** is ON, detector **16**A and detector **16**B always transmit ON signal according to the position of magnet **13** to controller **18** from at least one of detectors **16**.

Accordingly, OFF signal is not usually transmitted to controller **18** from both of detector **16**A and detector **16**B.

In other words, when ignition switch **33** is ON, in case OFF signal is transmitted to controller **18** from both of detector **16**A and detector **16**B simultaneously, it can be detected that one of detectors **16** is out of order.

Specifically, the detail is as follows. In normal condition, when brake pedal **30** is not pressed as shown in FIG. **6**A, ON signal is transmitted to controller **18** from detector **16**A, and OFF signal is transmitted to controller **18** from detector **16**B. However, when detector **16**A is out of order, OFF signal is transmitted to controller **18** from both of detector **16**A and detector **16**B. Controller **18** receiving the OFF signal from both of detector **16**A and detector **16**B determines that detector **16** is out of order and operates the alarm device **35** via switching part **7**.

Similarly, in normal condition, when brake pedal **30** is depressed as shown in FIG. **6**C, Off signal is transmitted to controller **18** from detector **16**A, and ON signal is transmitted to controller **18** from detector **16**B. However, in case detector **16**B is out of order, OFF signal is transmitted to controller **18** from both of detector **16**A and detector **16**B. Controller **18** receiving the OFF signal from both detector **16**A and detector **16**B determines that detector **16**A and detector **16**B are out of order and operates the alarm device **35** via switching part **7**.

Particularly, in the first embodiment, when magnet **13** passes between detector **16**A and detector **16**B as shown in FIG. **6**B, ON signal is usually transmitted to controller **18** from both of detectors **16**A, **16**B. Thus, since the ranges of detection by detector **16**A and detector **16**B are overlapped each other, the state of transmitting OFF signal to controller **18** from both of detector **16**A and detector **16**B can be avoided, and thereby, it is possible to simplify the configuration and to perform highly reliable detection of trouble over the entire range of movement of magnet **13**.

Controller **18** performs the detection of brake pedal **30** depressed, on/off control of stop lamp **32**, and detection of trouble in detector **16** on the basis of ON signal and OFF signal transmitted from detector **16**A and detector **16**B. That is, as the elements used for detector **16**, similar advantages can be obtained by using elements having same characteristics. By using the element in common for detector **16**A and detector **16**B, it is possible to easily set up the switch **21** without problems such as use of a wrong part.

Detector **16**A and detector **16**B are arranged distance L apart from each other, and magnet **13** is arranged so that the N pole or the S pole is vertically faced to detector **16**A or detector **16**B. In such a configuration, for example, switch **21** can be configured even in case magnet **13** is as small as about 3 mm in height, 5 mm in length, and 2 mm in thickness. Moreover, in this configuration, even in case of using two detectors (detector **16**A and detector **16**B), the overall height of switch **21** can be relatively decreased.

The size of switch **21** can be more reduced by using neodymium type magnet **13** being high in remanent magnetic flux density, and for detector **16**A and detector **16**B, Hall Element whose sensitivity is not high enough to detect magnetism when the flux density is 10 mT or less.

Detector **16**A and detector **16**B are disposed on the surface opposing to magnet **13** fixed to actuator **2**. Controller **18** uses detector **16**A and detector **16**B to detect the magnetism of magnet **13**. In use of this first embodiment, controller **18** detects the ON/OFF signal detected by detector **16**A and detector **16**B, and thereby, it is possible to obtain a switch which is structurally simple and capable of reliable detection of trouble, and a switch device using the switch.

In the above description, controller **18** executes the on/off control of stop lamp **32** by using detector **16**A and detector **16**B. Unlike the configuration described above, it is also preferable to be configured in that controller **18** sets the switching part **7** to ON when brake pedal **30** is not depressed and sets the switching part **7** to OFF when brake pedal **30** is depressed. And the present invention can be realized by connecting such a switch to the electronic circuit of a motor vehicle for example in order to achieve the purpose of controlling an auto-cruise or the like that keeps the running speed of the motor vehicle constant.

In the above description, controller **18** and switching part **7** are integrated with switch **21** in the configuration. It is also preferable to use a configuration in which such components are included in the electronic circuit of a motor vehicle, while only detector **16**A and detector **16**B are disposed on wiring board **5**.

The switch and the switch device based on the first embodiment of the present invention are structurally simplified and capable of reliable detection of trouble. The switch and the switch device are useful for on/off control of a stop lamp of a motor vehicle.

What is claimed is:

1. A switch comprising:

a casing;

an actuator movable in a predetermined direction with respect to the casing;

a magnet fixed to the actuator;

a first detector fixed to the casing, the first detector being adapted to detect magnetism generated from the magnet; and

a second detector disposed at a position apart from the first detector by a predetermined distance along the predetermined direction, the second detector being adapted to detect magnetism generated from the magnet, wherein

the magnet moves along the predetermined direction, and a movable range of the magnet is limited between a first point and a second point, and

the predetermined distance is determined, such that

when the magnet is positioned at the first point, the first detector detects the magnetism, while the second detector does not detect the magnetism,

when the magnet is positioned at the second point, the first detector does not detect the magnetism, while the second detector detects the magnetism, and

at every position of the magnet between the first point and the second point, either the first detector or the second detector detects the magnetism.

2. The switch of claim **1**, wherein the magnet is arranged so that an N pole and an S pole are positioned in a direction intersecting the predetermined direction.

3. A switch device comprising:

a casing;

an actuator which is movable in a predetermined direction with respect to the casing;

a magnet fixed to the actuator;

a first detector fixed to the casing, the first detector being adapted to detect magnetism generated from the magnet;

a second detector disposed at a position apart from the first detector by a predetermined distance along the predetermined direction, the second detector being adapted to detect magnetism generated from the magnet; and

a controller for detecting relative positions between the actuator and the casing, and for detecting an abnormality of the first detector and an abnormality of the second detector from a detection result of the first detector and a detection result of the second detector, wherein

the magnet moves along the predetermined direction, and a movable range of the magnet is limited between a first point and a second point, and

the specified distance is determined, such that

when the magnet is positioned at the first point, the first detector detects the magnetism, while the second detector does not detect the magnetism,

when the magnet is positioned at the second point, the first detector does not detect the magnetism, while the second detector detects the magnetism, and

at every position of the magnet between the first point and the second point, either the first detector or the second detector detects the magnetism.

4. The switch device of claim **3**, wherein the controller detects that the abnormality is generated when the first detector and the second detector do not detect the magnetism simultaneously.

5. The switch device of claim **3**, further comprising an alarm device which gives an alarm when the controller detects the abnormality of the first detector or the abnormality of the second detector from detection results of the first detector and detection results of the second detector.

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